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ABSTRACT

This report highlights and presents examples of the Commission on Physical Science, Mathematics, and Resources' (CPSMR) recent activities and future plans. Selected programs and activities from the 224 boards and committees that operate within CPSMR are reviewed. These range from studies of basic science to examinations of applied science and engineering from matters that are primarily scientific and technical to those with policy implications, from issues involving a single discipline to those crossing many disciplines. Areas addressed include: (1) state of the disciplines (with references to astrophysics, chemistry, and new technologies); (2) structure and management of the commission (listing of the standing boards); (3) program accomplishments (explanations of reports on acid deposition, changing climate, and waste disposal operations); (4) current activities (projects concerned with atmospheric effects of nuclear war, ocean science, and international geosphere-biosphere relations); (5) future studies (dealing with nuclear power, space science and materials in space); (6) critical issues (organizational concerns and priority guidelines); (7) modes of response (detailing procedures of letter reports, compressed response, and round table discussion); and (8) financial matters (information on expenditures). (ML)

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ANNUAL REPORT

OF THE

COMMISSION ON PHYSICAL SCIENCES, MATHEMATICS, AND RESOURCES

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JUNE 1984

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ANNUAL REPORT

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JUNE 1984

The activities of the Commission on Physical Sciences, Mathematics, and Resources (CPSMR) span a large and diverse range of subjects. Two hundred twenty four Boards and committees within CPSMR involving some 1800 individuals (their numbers changing often as new committees are formed and old ones disbanded) are at work on a vast array of activities--from reviews of basic sciences to examinations of applied sciences and engineering, from matters that are primarily scientific and technical to those with significant policy implications, from issues involving only a single discipline to those crossing many disciplines. As of May 1, 1984, 90 reports were in various stages of preparation by the Commission and its components (compared to 75 reports a year ago). Commission program expenditures for fiscal year 1983 were about $7,600,000; for the first ten months of fiscal year 1984, expenditures were about $7,060,000 (representing an annual rate of about $8,470,000). The appendixes to this annual report provide discussions of the current activities of the Commission; the report itself will, of necessity, concentrate on highlights and illustrative examples of the Commission's recent activities and future plans.

PHYSICAL SCIENCES AND RESOURCES-THE STATE OF THE DISCIPLINES

Like most generations of scientists past, today's physicists, chemists, mathematicians, and earth scientists look at the present and the near future as "exciting times for science," --times of great opportunity for the development of new ideas and deeper and more accurate understanding of the world about them. The optimism and excitement are based on significant advancements both in the tools and instruments for exploration and experimentation and in theories within the disciplines that model and predict the observed phenomena.

Within the Commission a number of recently completed and ongoing reviews provide a picture of the vitality and potential of contemporary physics, chemistry, mathematics, astronomy, space science, earth science, and chemical engineering. It is not the purpose of this report to quote at length from those state-of-the-art reviews, but it is appropriate to begin with a brief sketch of the challenging and dynamic milieu in which the Commission operates.

One of the remarkable developments in the physical sciences in recent years has been the progress toward a more unified theory of processes that seem to be quite distinct. Astrophysics and cosmology--sciences dealing with the largest size scales--and particle physics--a science dealing with the smallest--now find themselves asking the same questions. One can almost think of the earliest moments of the universe as the result of a particle physics experiment performed at enormously high energies. Neutron stars are test objects for the properties of matter at extremely high densities and temperatures. The study of black holes using x-ray astronomy is testing and challenging general relativity theory. The development of detection devices of unprecedented sensitivity will permit the testing of predictions of gravitational wave amplitude from such objects as the collapsing cores of supernovae and active galactic nuclei.

Chemistry, too, is at an interesting and important stage. The development of powerful instrumental probes enables chemists to address fundamental questions that were beyond the limits of measurement a decade ago. Lasers and computers allow the tracking of chemical changes that take place in nanoseconds or picoseconds. In addition, lasers permit detection and identification of transient molecular species in concentrations as small as a few parts per billion. Diagnostic and synthetic capabilities with complex molecules--a result of the development of such tools as high field, pulsed, and Fourier Transform Nuclear Magnetic Resonance; computer-controlled x-ray spectroscopy; and high resolution mass spectrometry--are also opening new frontiers. Chemists are developing entirely new families of metal organic molecules that may serve as powerful soluble catalysts and that, despite the structural and conformational complexity involved, are contributing actively to the study of biological molecules. Research on solid catalysis is also progressing at a rapid rate because of the availability of a host of powerful experimental methods such as Auger spectroscopy, electron energy loss spectroscopy, and low energy electron diffraction.

New technologies for the remote sensing of atmospheric, geological, biological, and oceanographic processes and conditions promise to revolutionize our understanding of the earth and its changes. Global seafloor mapping using radar altimetry from the vantage of earth orbit, for example, has portrayed the large features of sea mounts and ocean trenches with remarkable clarity. It also revealed, for the first time, an unexpected range of seafloor features such as underwater volcanoes, tectonic fracture zones across the plates, swales of ocean crust with unusual gravitational characteristics, and even a smooth underwater plateau as large as the state of California. Fracture zones mapped from the perspective of space can be followed across entire ocean basins, even where they are covered by sediment.

In recent years, the funding situation in the physical sciences has been good enough to allow scientists to focus on major opportunities as they set their research goals for the future. But there are some clouds on an otherwise bright horizon. We mention them only briefly in closing here although they demand the thoughtful attention of the scientific community and those who allocate and administer its resources. Concerns have been raised--and documented--about the decaying state of instrumentation and facilities in universities. The research universities have been one of the focal points of the American scientific enterprise and the nation can permit the deterioration of tools of research in its universities only at great peril to its continued preeminence in the physical sciences.

The future of American science is also threatened by the now widely acknowledged deficiencies in our elementary and secondary educational system, deficiencies that seem particularly evident in the teaching and learning of science and mathematics. For the present, pronouncements of the problem are easier to find than are proposed solutions although the current surge of attention to the issue may lead to constructive action in the future.

STRUCTURE AND MANAGEMENT OF THE COMMISSION

The Commission (whose current membership is listed in Appendix I) establishes policy, provides general substantive guidance, and directs project initiation, committee appointment, and report review functions; detailed substantive oversight of its many activities, however, is carried out by a number of standing Boards composed of experts in particular fields. The Boards include:

- Board on Chemical Sciences and Technology
- Board on Physics and Astronomy
- Board on Mathematical Sciences (in formation)
- Numerical Data Advisory Board
- Board on Assessment of National Bureau of Standards Programs
- Computer Science and Technology Board
- Space Science Board
- Naval Studies Board
- Board on Atmospheric Sciences and Climate
- Board on Ocean Science and Policy
- Environmental Studies Board
- Polar Research Board
- Water Science and Technology Board (jointly with the Commission on Engineering and Technical Systems)
- Board on Earth Sciences
- Geophysics Research Forum
- Board on Mineral and Energy Resources
- Board on Radioactive Waste Management

The Commission also has responsibility for direction of the activities of 18 national committees that are the United States' representatives to international scientific organizations; detailed oversight of these national committees lies with the appropriate standing Boards.

PROGRAM ACCOMPLISHMENTS

In the first ten months of the current fiscal year, committees and Boards within the Commission completed 52 reports (see Appendix IV). As with any set of NRC reports, some of them quite apparently had major impact on government decisionmakers while others seem to have left little indication that they had been used. The question of what constitutes a "successful" report is, of course, difficult to answer, but it is one to which CPSMR members and staff devote considerable attention. It has been proposed that a retrospective look be taken at how past reports have been received and used and the Commission will almost certainly attempt such an exercise.

Of the large number of reports produced within CPSMR in the last year, some also received considerable attention from the press. It should be noted that "attention"--whether from the press, the government, or the public--cannot be used, in and of itself, as a measure of a report's success. Indeed, it can be demonstrated that some of the NRC reports that attract most attention are clearly "unsuccessful" in affecting policy or public understanding. A brief review like this cannot fairly describe the reactions to all the CPSMR reports produced in the last year, but we can highlight a few studies that created conspicuous interest and attention after their release.

Perhaps the most visible, the most influential, and the most quoted (and misquoted) of CPSMR's recent reports was Acid Deposition: Atmospheric Processes in Eastern North America. The report, which described the current state of knowledge about the transport and transformation of the air pollutants that result in acid rain, provided government decision makers with information that filled an important gap in our understanding of the acid rain problem. Its appearance and acceptance allowed the ongoing debate over appropriate control strategies to focus on important political and value judgments rather than on incomplete and often incorrect scientific assertions. The NRC's influential role in providing a clarification of current understanding of the phenomena of acid deposition was a major reason that the National Academy of Sciences and the National Academy of Engineering recently received the National Wildlife Federation's award as Conservationist of the Year for 1983.

Another report on an environmental issue also attracted widespread interest. Changing Climate, a comprehensive assessment of the potential effects of increasing carbon dioxide

levels in the atmosphere, analyzed a major, long-term problem and provided ways of thinking about problems of uncertain, but potentially significant, impact.

Many Commission reports examined the conduct of science itself, identifying areas of promise and opportunity. A particularly interesting example was the result of a workshop on Multidisciplinary Uses of the Very Long Baseline Array (VLBA). The VLBA has been sought as a tool for astronomers that would permit the observation of distant radio-emitting celestial objects, such as quasars, with very high angular resolution. The VLBA would comprise ten widely spaced antennas whose signals would be precisely synchronized and combined with the aid of computer processing to yield a radio emission image with a resolution of 0.3 milliarc sec at a wavelength of 6 cm. But the VLBA is an expensive tool and although it might have been justified for astronomical purposes alone, it has some important applications to earth sciences. It could provide extremely precise determination of distances between points on the earth that would allow measurement of crustal motion as small as 1 cm per year and it could allow accurate determination of universal time, polar wobble, and variation of the earth's spin. The Commission's report is currently being used as a basis for justification of the inclusion of the VLBA in the current budget.

Recently, the Board on Chemical Sciences and Technology issued practical guidelines for laboratories on the handling and disposal of waste chemicals. Although research laboratories, which use small quantities of diverse chemicals, are estimated to account for less than one percent of the hazardous waste in the United States, they are subject to comprehensive waste disposal requirements designed primarily for industrial wastes. The BCST report offers practical information on (a) essentials of a plan for managing laboratory waste; (b) recovery and reuse of chemicals as a way to reduce waste volume; and (c) safe on-site waste destruction and neutralization technologies. The report also recommends state and federal actions to help laboratories comply efficiently with environmental goals, including creation of an omnibus class of "miscellaneous laboratory chemicals" to simplify record keeping.

As a result of general concerns about the safety of contemplated waste disposal operations, the Swedish Parliament mandated that detailed plans for safe disposal be completed before the initial loading of fuel into new Swedish power plants would be authorized. As part of its evaluation of the recently proposed plan designated "KBS-3", the Swedish government invited review by the National Research Council. The review panel established by the Board on Radioactive Waste Management emphasized those portions of the plan that relate to overall waste cannister and repository design and to the calculations and supporting data related to waste form dissolution and radionuclide migration through the surrounding geosphere. The review panel judged that the KBS-3 plan provides an adequate technical basis for the conclusions that the plan reaches--that

there is reasonable assurance that a waste repository built according to the plan will not permit an unacceptable rate of radionuclide escape. Some suggestions for additional research were also provided.

CURRENT ACTIVITIES

Descriptions of each of the studies now in progress within CPSMR appear in Appendix III. The range of studies is represented by the following samples.

Atmospheric Effects of Nuclear War

There is little scientific doubt about the devastating immediate effects of nuclear war. Nuclear blast damage and radioactive fallout would have cataclysmic and lasting effects on human society. There is much less certainty, however, about later effects on areas not in the blast range or subject to damaging amounts of radioactive fall-out. Recent studies suggest that major disruptions in atmospheric and climatic conditions, which could prove an independent source of human and ecological devastation, may be triggered by nuclear war. Possibilities cited include (a) significant depletion of the stratospheric ozone layer caused by the injection of large amounts of nitrogen oxides from the nuclear fireball; (b) effects on atmospheric and surface temperatures and surface light levels from the lofting of small dust particles in the nuclear cloud; and (c) similar effects caused by the smoke from many uncontrolled urban fires and wild fires ignited by thermal radiation from nuclear detonation.

A Committee on Atmospheric Effects of Nuclear Explosions was charged to examine these and other atmospheric effects without attempting to estimate their biological consequences. The Committee first met in March 1983 and hopes to complete its work with the release of an unclassified report later this year.

Acid Deposition

The Environmental Studies Board is continuing its work on acid deposition, which began with the 1983 publication of Acid Deposition: Atmospheric Processes in Eastern North America. Three efforts are under way:

1. Acid Rain Steering Committee: With the rapid evolution of new scientific work on acid rain, government agencies have recognized a need for a standing group that can treat specific issues as they arise.

The EPA and the Federal Interagency Task Force on Acid Precipitation have asked the Chairman of the NRC to establish a mechanism for providing scientific advice on a series of

scientific issues that may be expected to arise over the next few years. The nature of the advice to be provided is likely to vary considerably. Issues that might be addressed include, for example, the probability that research on a particular subject will yield specific results by a particular time, the degree to which anticipated results will, in fact, fill a gap in knowledge, and the importance of various gaps in knowledge to our confidence in accepting cause-effect relationships.

The first response to the request for assistance, a session on lake acidification processes, attended by EPA Administrator Ruckelshaus was held in early 1984.

2. Historical Trends: Data on precipitation chemistry related to long-term historical trends in nitrate, sulfate, and pH are scarce, and the data that are available are open to criticism. An ESB committee's approach to narrowing the uncertainty in long-term trends has been to examine the sum of available historical evidence from a variety of data sources that may be related to acid deposition. The data concern trends in emissions, visibility, lake sediments, tree rings, surface water chemistry, glacial ice cores, fish populations, and meteorology. Examined independently, none of the data sets may provide definitive information on trends, but analysis of the combined sets may provide new insights. It is anticipated that the study will also identify the types of data that appear to be the most fruitful in determining long-term trends in acid deposition.

3. Tri-Academy Committee: The Tri-Academy Committee on Acid Deposition is charged with developing cooperation between the Royal Society of Canada (RSC), the Academia de la Investigacion Cientifica (AIC) of Mexico, and the National Academy of Sciences (NAS). The Committee reviews the adequacy of current and prospective research and monitoring activities related to solving environmental problems created by atmospheric deposition. A focus of past joint meetings has been on transboundary air pollution problems involving Canada and the United States and on air pollution in the Mexico City basin. The Committee has also studied the vulnerability of peatlands to atmospheric deposition and has prepared a comprehensive report on the effects of acid deposition on the natural cycling of trace metals.

Ocean Science and Policy

The Board on Ocean Science and Policy has embarked on a general review of the status and future objectives of ocean science and policy studies that will define major goals and specify strategies required by the year 2000 to fulfill them. Three interlocking areas will be examined: scientific questions, policy issues, and technological constraints. The review will identify critical issues and priorities, formulate strategies for addressing the issues, and provide recommendations for long-range planning that reflect a consensus of the oceanographic community.

Ocean studies--both in science and policy--are currently in a critical period of growth and change. Ocean science, through the development of new technologies, such as remote sensing and improved sampling schemes, is now producing synoptic and global observations of complex ocean phenomena. As a result, large, multidisciplinary scientific research programs are being planned with increasing emphasis on global perspective and interfaces between component disciplines of oceanography. It is important for the ocean community that the most critical scientific problems be identified and that priorities be clearly set to guide the most effective development and use of new platforms and technologies.

International Geosphere-Biosphere Program (IGBP)

The subtle and complex nature of the interlacing connections that tie the geosphere and biosphere together lies outside the scope of any one discipline. If it were possible to institutionalize a long-range, cooperative, interdisciplinary scientific effort on an international scale, we might find long sought but elusive answers to the physical, chemical, and biological workings of the sun-earth system and biosphere.

The initiative of the Commission in advancing the concept for geosphere-biosphere studies is being warmly received by the ICSU family of scientific unions and its special committees. The initiative is also receiving support from the various agencies of government that deal with the geosphere-biosphere complex of sciences. The report on last summer's Woods Hole workshop has been widely disseminated and has been an effective tool for clarifying the goals of an international program. A new committee for the IGBP has been established, and it will have a second Woods Hole workshop this month. Specific models for national and international coordination will be discussed and designed at the workshop and later reported to a symposium on IGBP scheduled for the ICSU General Assembly in Ottawa in September 1984. The outcome could be the establishment of a special ICSU committee for IGBP to carry forward the international organization.

Field Surveys

The Commission expects to complete three major surveys next year in the fields of physics, chemistry, and chemical engineering.

The Physics Survey has formed panels that will address all the subdisciplines of physics: atomic, molecular, and optical physics; condensed-matter physics; cosmic and gravitational physics; elementary particle physics; nuclear physics; and plasma and fluid physics. There will be two cross-cutting reports: one on interfaces and applications, the other an overview that will synthesize the various panel reports. The subdiscipline reports are nearly complete, and the survey is now focusing on the

overview. The overview will cover the following topics: physics and society; progress in physics; international competition and cooperation; education and supply of physicists; organization and support of physics; and recommendations. Some of the important and exciting developments in physics to be covered are: unification of the forces of nature (combining electromagnetic and weak forces into one theory, and combining that with the theory of strong interactions known as quantum chromodynamics); the quark-gluon structure of the nucleus; quantum electrodynamics effects on energy levels in atoms; breakthroughs in the understanding of phase transitions; new insights into the nature of the transition from laminar to turbulent fluid flow; and contributions of unified elementary particle theories to cosmology. The report will recognize that major new facilities will be required in order to exploit the opportunities in these areas. A research briefing for the President's Science Advisor and key federal agency personnel based on the survey is planned for fall 1984.

The Committee to Survey the Chemical Sciences was organized in 1982. This broad effort, the first in the field since the Westheimer report was published in 1965, is surveying intellectual frontiers in the chemical sciences and the opportunities they present for meeting critical societal needs. The report of the Committee will offer recommendations and suggest priorities for federal support of chemistry. The Committee organized research briefings for the President's Science Advisor and for research managers of NSF, NIH, DOE, DOD, and OMB in October 1983.

A Committee to Survey Chemical Engineering is currently being organized in cooperation with the NRC Commission on Engineering and Technical Systems (CETS). With goals similar to those of the other surveys, the Committee will review the array of intellectual frontiers in chemical engineering and their potential impacts on society. The Committee's report will describe the challenges and opportunities in the field and enhance our awareness of society's dependence on advances in chemical engineering for progress in meeting critical needs and solving problems, and in so doing strengthen the base for policy decisions, including those involving funding priorities within and among disciplines

FUTURE STUDIES

CPSMR studies frequently arise unpredictably out of informal government-NRC interactions, and this contributes to the difficulty of anticipating details of future CPSMR programs. The three examples that follow are illustrative of studies now in the planning stage or under assessment for their feasibility.

The Future of Nuclear Power

A CPSMR committee is assessing the need for an examination of alternative future institutional and technological configurations for nuclear power generation. The possibility of future energy crises cannot be ruled out, and if one does occur, the nation may need to re-examine the role of nuclear power technologies. The Committee is considering whether a major study begun now might prevent such an assessment from being limited to currently available approaches.

Space Science 1995-2015

The 1990s mark the end of the current National Aeronautic and Space Administration (NASA) science mission plan and the anticipated beginning of the operational phase of the space station, when a distinct shift in the conduct of space science will occur. When it recently approved development of the space station, the Administration urged NASA to define subsequent goals for the various elements of the space program. For the space science portion of this task the NASA Administrator has turned to the Space Science Board, which is NASA's principal external source of advice and guidance on the space science program. In the past this advice has taken the form of ten-year science strategies for all the major disciplines. The SSB ten-year strategies and the results of missions to date will form the basis for studying new directions for space science in the designated period.

Materials in Space

Various processes have been found to work exceedingly well in the zero-gravity environment. Crystals of extraordinary perfection can be made at zero-gravity. Chemical separation using electrophoresis is greatly enhanced. In part because of renewed interest in gallium-arsenide based semiconductors for high-speed computation, there is special interest in growing GaAs crystals in the low-gravity environment that could be provided by the Shuttle or by a permanent station in space. While such approaches may be possible, questions remain about their cost effectiveness. The Solid State Sciences Committee plans to hold a workshop this month to review the prospects of zero-gravity process technologies and to consider the desirability of a full-scale assessment.

ISSUES REQUIRING ATTENTION

The Commission's Midterm Review, written just over a year ago, reported some concerns about the role of mathematics and related disciplines within the NRC. Without major difficulty, the Commission had assigned oversight responsibility in physics, in chemical sciences and technology, and in earth sciences to

newly created standing Boards. Those Boards were also charged with the generation and development of new programs and projects and with establishing a link between members of the Academies and NRC activities. The organizational step was accomplished with relative ease because the Commission's program already included enough activity in these areas to permit the new function to be covered out of project funds in direct cost accounts. In mathematics, however, the CPSMR program was not active enough to sustain a standing Board. But the picture has changed. We are now close to reaching agreement with (and obtaining funds from) a group of government agencies to establish a Board on Mathematical Sciences to oversee NRC activities in mathematics and statistics. Arriving at this point has presented some difficulties. Much of the groundwork was done at the initiative of pure mathematicians; statisticians felt left out or ignored. Early concepts of the Board linked mathematics and computer sciences; computer scientists argued persuasively that computer science was not a branch of mathematics but rather a discipline of its own. The difficulties have now been, for the most part, resolved. The statisticians have gained a stronger voice and computer science will remain in the purview of the Computer Science and Technology Board. At its next meeting, if all goes well with the contract negotiations, the Commission will nominate members for the Board.

Another issue of concern to the Commission is not organizational in nature but relates to a recent change in the kinds of requests for assistance that are being received from government agencies. Although the NRC has long helped agencies in setting research priorities and agendas, most of the work has involved relatively narrow disciplines or fields of science. Recently, however, the Commission has been asked to set--or to help set--priorities <u>across</u> fields of science. As difficult as it may be to establish priorities within a constrained area of interest--say, atomic physics or seismology--it is considerably more difficult to evaluate opportunities in broader areas--like astronomy as a whole, or materials science, or energy-related research. The change in the nature of the requests results from at least two factors. First, as facilities and equipment become ever more expensive in certain areas of science, decisions to go ahead with any one area of research are more likely to have major, and possibly adverse, impacts on the conduct of work in other areas. Second, as Frank Press noted in his Annual Report to the members of the National Academy of Sciences, "...in the recent past, there has been a distressing trend toward the use of political lobbying to urge the funding of major scientific facilities, hence bypassing the traditional--and quite successful--peer review process for the evaluation of proposals." The government is turning to the NRC to help reverse the trend thus agreeing with Dr. Press's assertion that "soliciting the views of the country's best scientists about needs, opportunities, and priorities in the allocation of resources for science surely serves the country better than decisions based on the influence of paid political lobbyists."

The first reaction of the volunteer scientists who serve on NRC committees that receive requests to review and recommend priorities in broad areas of science is almost invariably negative. But the reluctance is almost always overcome by the realization that priorities will be set on some basis even if the scientific community does not participate. The Commission, in undertaking broad priority-setting exercises, recognizes the difficulty of carrying them out competently and fairly and places great emphasis on assuring appropriate composition of the study committees and careful review of their recommendations.

MODES OF RESPONSE

Much of the work of the Commission--like that of most of the NRC--is done by committees that take a year or two to complete their deliberations and prepare a report. The standard mode permits careful consideration of issues and allows time for a meaningful and often constructive review process. Volunteer committee members can spread out their contributions of time and effort and give considerable attention to the preparation of a cogent, well-documented report. The fact that the great majority of NRC activities takes place over an extended time scale has given the institution a reputation, both within and outside the government, as a deliberative and comprehensive assessor of issues with significant scientific and technical components. But it has also led to a feeling that when quick responses are called for, the NRC is not a particularly appropriate source of advice.

Since government agencies do often need advice more quickly than the traditional long-term committee exercise can be expected to provide it, the question has been raised by government officials, by the Commission, and by the executive office and Governing Board of the NRC as to whether there are ways that this institution can respond more rapidly, when necessary, without compromising its independence or its insistence on the high quality of its substantive advice.

The concern about more rapid response should not be misconstrued. In all likelihood, the bulk of the activities of the NRC will continue to be one- and two-year, comprehensive reviews of problems and issues. The NRC has demonstrated through the years its ability to perform such studies well and by means of them to provide useful advice to government. Nonetheless, the Commission and the rest of the NRC have been experimenting with new modes of response that can increase the NRC's value to government and the public. Within CPSMR, three non-traditional response modes have been and are being tried.

Letter reports--brief comments on particular issues of interest to a government agency or the scientific community or both--have for some time been used by such groups as the Space

Science Board and the Naval Studies Board to respond rapidly to sponsors about matters of pressing concern. Usually based upon extensive discussions within a Board or committee or upon already completed long-term studies, letter reports, of necessity, include less detailed discussion of evidence and less elaborate analysis than the more traditional reports. Consequently, letter reports can stress the NRC's review process--sometimes severely. Commission members and the Report Review Committee review letter reports quickly on short notice, a task that is made possible only by the fact that letter reports tend to be considerably shorter than other reports. The thread of argument is also usually more apparent, allowing reviewers to examine easily the logic and emphasis of the report.

Another way of reacting to the need for quick response is that of compressing the traditional study process in time while retaining its major characteristics. Thus, on occasion, a committee will be established, deliberate and discuss issues, prepare a report, and obtain and respond to extensive review comments in a period of less than six months. The Commission's current review of priorities for major facilities for materials science is an example of such a compressed response. All the standard institutional procedures are being used--wide solicitation of nominees for the committee, extensive information gathering, preparation of a documented report, and extensive review of the report--but on a shorter time scale. Clearly this stresses a system designed to operate at a more deliberate pace, but it seems to work as long as it is attempted only in special cases.

In the last year, the roundtable discussion approach was tried at the request of Environmental Protection Agency Administrator William Ruckelshaus. Distracted and confused by conflicting statements of scientists about what seemed to be the same scientific data in the acid rain controversy, Ruckelshaus asked the NRC to convene groups of scientists to discuss, with him, a focussed set of questions on the state of scientific knowledge. Two such roundtable discussions have now been held: one on atmospheric processes and another on lake acidification. In each case, the group of scientists was carefully selected to assure a balance of viewpoints and approaches. The written products of the roundtables differed: a verbatim transcript of the first meeting was sent to EPA and a summary of the discussion at the second meeting was prepared. Every effort was made to make clear that the documents were not the result of a deliberative committee process but the product of a several-hour-long discussion among a number of scientists. Here, too, the review process has been stressed. Reviewers, who were present at the discussion, verified the accuracy of the summary of the lake acidification roundtable. The standard used by the reviewers, it should be noted, differed from that used by reviewers of traditional reports. In subsequent evaluations of the process, however, the Commission felt quite strongly that the value and timeliness of the roundtables offset any problems created in the review process or in assuring the proper

exposition of the nature of the discussion in the documents provided to the sponsors.

FINANCIAL MATTERS

CPSMR has existed for about two years, hardly long enough to come to any sweeping conclusions about stability or trends in its finances. Nonetheless, an examination of expenditures provides some interesting indications and food for thought.

o In FY 1983, its first complete fiscal year, the Commission spent about $7.6M. With fewer than two months left in FY 1984, it can be estimated with a good deal of confidence that the Commission will spend about $8.4M (a 10.5 percent increase).

o All but five of the seventeen units of the Commission showed increases in expenditure levels in 1984 over 1983 (see Figure 1) with the most significant increase occurring in the Board on Physics and Astronomy (reflecting the Physics Survey, the study of Atmospheric Effects of Nuclear Explosions, and increased activity of the Solid State Sciences Committee), and in the Environmental Studies Board (reflecting increased activity in acid rain studies and the initiation of a senior visiting scientist program with the Environmental Protection Agency). The most significant decrease is in the Board on Mineral and Energy Resources, but the Board works on a few large projects at any given time so that its expenditures are susceptible to sizeable variations as old projects end or new ones begin.

o Funding patterns by sponsor (Figures 2 and 3) reveal something of a diversification of support. The two major sponsors (NSF and DOE) decreased their support in the last year; in FY 1983 the two accounted for about 42 percent of the total support of the Commission; in FY 1984 they will account for about 32 percent. It is too early to tell whether one should be pleased at the spreading of support or concerned about the decrease in support from NSF and DOE. The increase in funding from the Department of Commerce is less meaningful than it appears. Some of the funding for the Board on Ocean Science and Policy and for the Board on Atmospheric Sciences and Climate is collected by NOAA from a group of government agencies and provided to the NRC through a contract with NOAA. Indeed, the harsh realities of the funding situation at NOAA indicate that real funding from that agency might well decrease in the near future.

o Only a little more than a quarter of the increase in private funding represents use of the NRC Consortium funds; the remainder comes from individual grants from foundations and industry for specific projects.

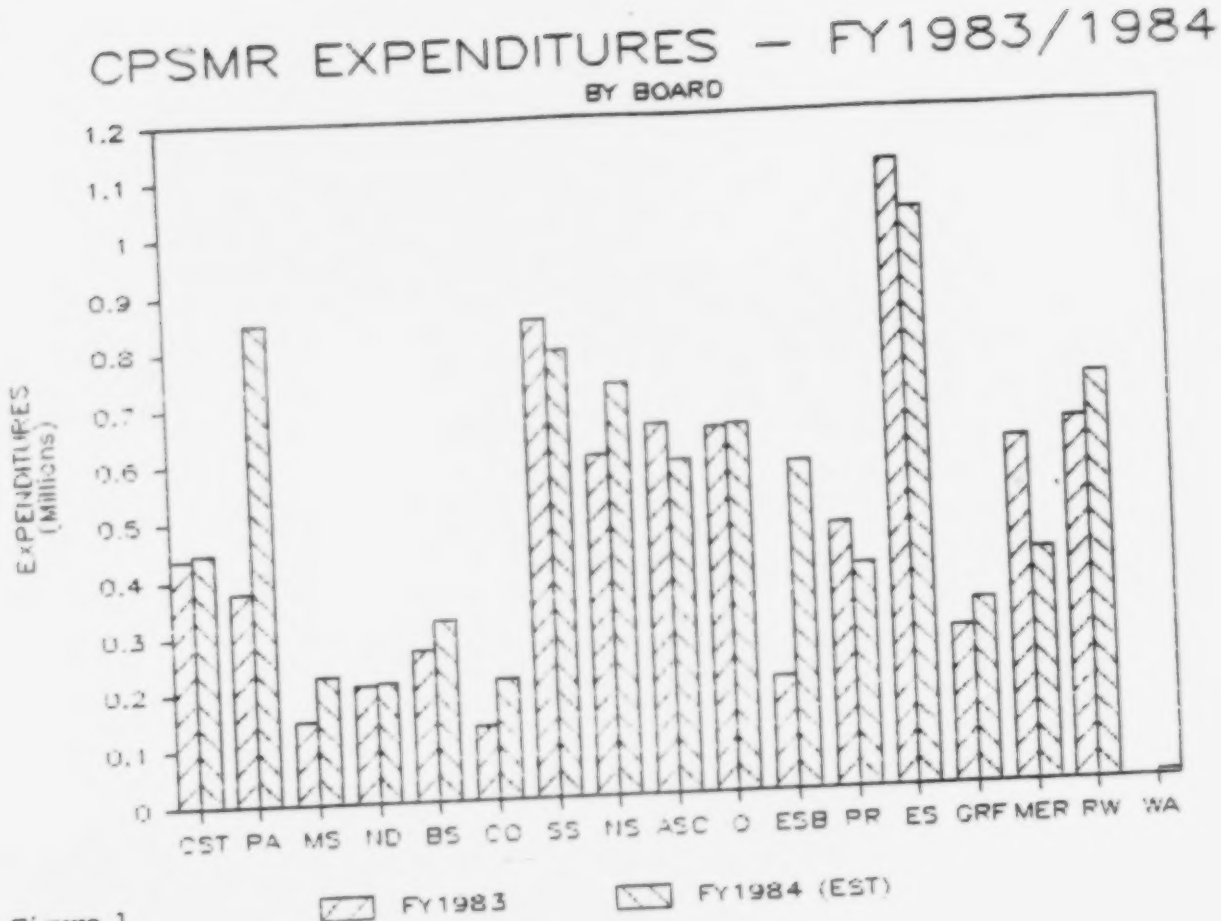

Figure 1

CST	Board on Chemical Sciences and Technology
PA	Board on Physics and Astronomy
MS	Board on Mathematical Sciences
ND	Numerical Data Advisory Board
BS	Board on Assessment of NBS Programs
CO	Computer Science and Technology Board
SS	Space Science Board
NS	Naval Studies Board
ASC	Board on Atmospheric Sciences and Climate
O	Board on Ocean Science and Policy
ESB	Environmental Studies Board
PR	Polar Research Board
ES	Board on Earth Sciences
GRF	Geophysics Research Forum
MER	Board on Mineral and Energy Resources
RW	Board on Radioactive Waste Management
WA	Water Science and Technology Board

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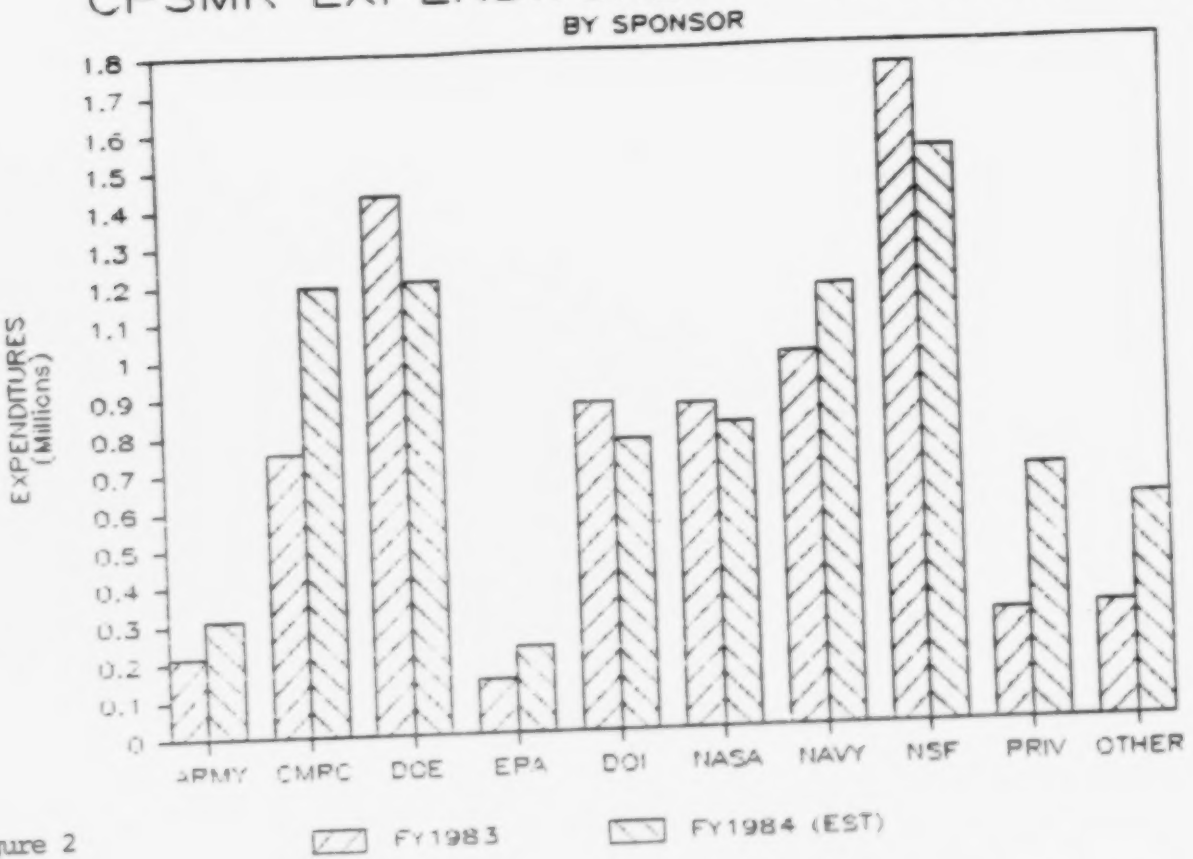

Figure 2

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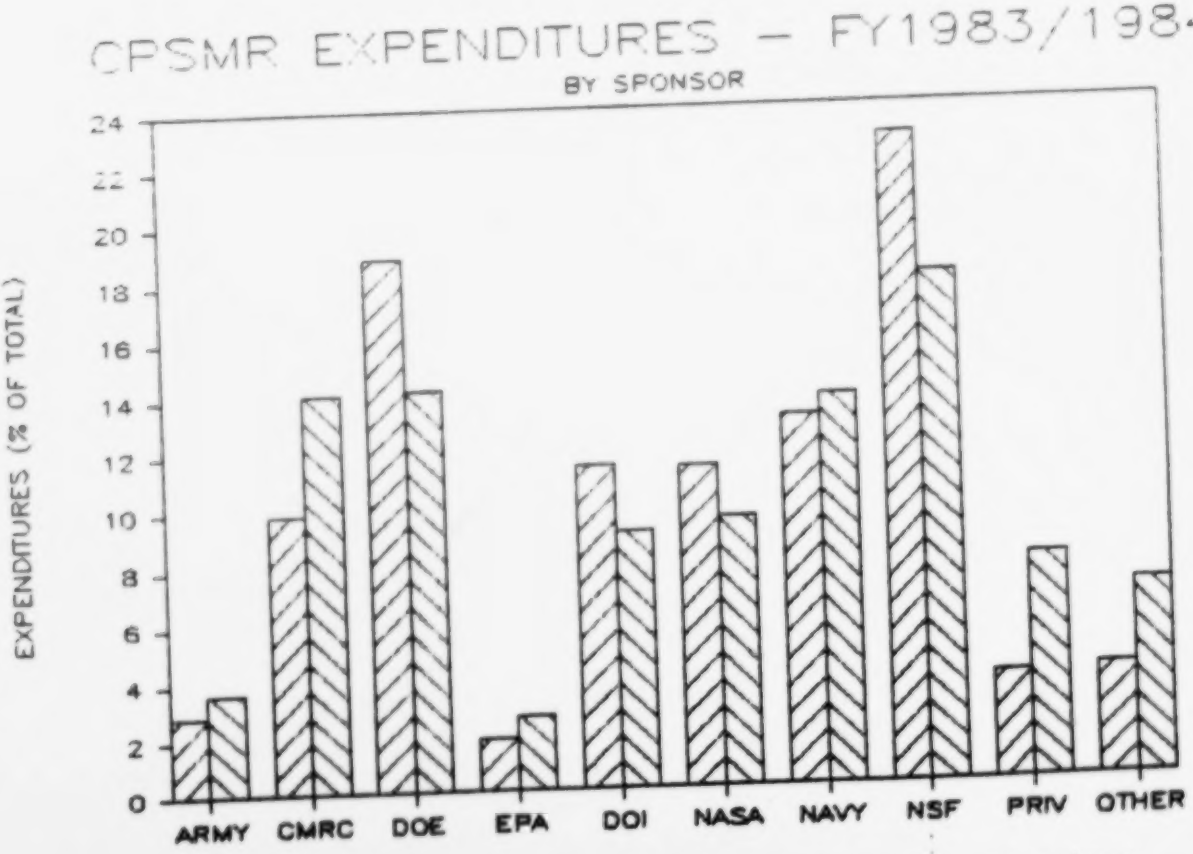

Figure 3

Budget projections for FY 1985 indicate that the significant increase in program expenditures between 1983 and 1984 will not be repeated. Indeed, as the major disciplinary surveys come to an end, expenditures are expected to level off or, perhaps, drop by a couple of percent depending upon how quickly major new activities, such as the examination of future space science goals and the design of the International Geosphere-Biosphere Program, proceed.